In the United States Patent and Trademark Office

Serial No. _____
Appn. Filed : _____
Applicants: Yuri Glukhoy
Appn. Title: ELECTRON-CYCLOTRON RESONANCE TYPE ION BEAM SOURCE FOR ION IMPLANTER
Examiner/GAU: _____

Mailed: Nov 27/01
At: Foster City

Information Disclosure Statement

Assistant Commissioner for Patents
Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon. Following are comments on references pursuant to Rule 98:

V.V. Simonov, et al. in "Oborudovanie Ionnoi Implantatsii" (Ion Implantation Equipment), Moscow, "Radio I Svyaz" Publishers, 1988, pp. 35-38 describe ion implanters of old models based on cumbersome, complicated, and expensive ion acceleration technique.

U.S. Patent No. 5,625,195 issued to Andre Grouillet in 1997 discloses a high-energy implantation process using an ion implanter of the low- or medium-current type with an ECR ion source including a waveguide-forming plasma cavity whose characteristic dimension in the transverse plane of the cavity is of the same order of magnitude as the wavelength of the electromagnetic field. The microwave generator of this implanter and the plasma cavity of the multiple-charged ion source are electromagnetically coupled.

However, the ion source used in the implanter of U.S. Patent No. 5,625,195 produces a beam of a round cross section having a few centimeter in diameter at the source output with an energy of about 20-25 KeV. For further acceleration of ions to the level of energy required for implantation, the implanter that utilizes this source requires the use of an expensive and complicated ion-accelerating system, and without this system the implanter cannot develop beam energies sufficient for effective implantation. Furthermore, the ion source of U.S. Patent No. 5,625,195 does not ensure uniformity of the ion beam current over the entire cross section of the beam extracted directly from the ECR plasma source. Another disadvantage of the known ion source is that it does not allow for adjustment of ion beam current distribution at the input to the magnetic separator and beam accelerator.

US Patent Application No. 09/476,529 filed on 01.03.00 by the same applicant as the present patent application describes an ion source for implanting charged ions, e.g., of B^{++}, P^{++}, or the like, accelerated to the energy of a few hundred KeV. This ion source is characterized by radial direction of plasma extraction. However, this ion-beam source can produce ions only from gaseous working materials. The width of the beam cross-section is limited substantially to the length of the microwave pumping waveguide and this, in turn, limits efficiency of the implanter. The source does not have means for cleaning the windows through which the microwave energy is pumped into the plasma-confining chamber. Therefore, when the windows are contaminated to unacceptable degree, the entire system has to be stopped, the source has to be disassembled and the windows have to be cleaned or replaced. This disadvantage is reflected in increased costs of production and maintenance.

Thus, none of the aforementioned references discloses, as claimed in my independent Claim 1 with dependent Claims 2-27, an electron cyclotron resonance type ion source with radial direction of plasma extraction, in which the

RF pumping unit has a unique additional function of RF magnetron sputtering of solid targets converted into a gaseous working medium used for implantation in an ionized form and which is provided with a mechanism for continuously cleaning windows used for pumping microwave energy into the plasma-confining chamber. Furthermore, none of the aforementioned references discloses a method of generating an ion beam for use in an ion implanter characterized by simultaneous use of microwave and RF energy for increase of the plasma density and by cleaning windows for the supply of microwave energy into the plasma-confining space.

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